## DIOXIN AND DIOXIN-LIKE COMPOUNDS (DLCs)

## DIOXIN AND DIOXIN-LIKE COMPOUNDS

- PBT activity threshold: 0.1 gram
- Dioxin and dioxin-like compounds (DLCs) category qualifier reads:

  "Manufacturing; and the processing or otherwise use of dioxin and dioxin-like compounds if the dioxin and dioxin-like compounds are present as contaminants in a chemical and if they were created during the manufacturing of that chemical."

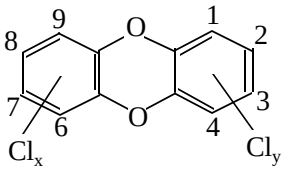
  - Qualifier designed to focus on new environmental loadings of dioxin and DLCs



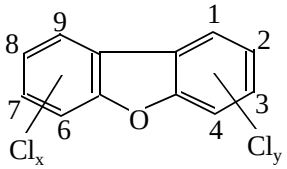
## DIOXIN AND DIOXIN-LIKE COMPOUNDS

- Category includes polychlorinated dioxins and furans with chlorine in at least the 2, 3, 7, and 8 positions

Dibenzo-p-dioxin




Dibenzofuran






## DIOXIN AND DIOXIN-LIKE COMPOUNDS

- Reporting must be based on total weight in grams of the members of the dioxin and DLCs category
  - Quantities of dioxin and DLCs entered on the Form R or into TRI-ME/ATRS must be in grams by weight
- Some literature contains information about dioxin and DLCs emissions in terms of grams TEQ (toxicity equivalency)
  - Do not use in threshold determinations
  - Do not report these values on Form R
- TEQs are based on toxicity equivalency factors (TEFs) for dioxin and DLCs, not just the weight
  - TEFs - estimates of the toxicity of dioxin and DLCs relative to the toxicity of 2,3,7,8-TCDD

## DIOXIN AND DIOXIN-LIKE COMPOUNDS

- **Form R Part II, Section 1.4 requires reporting of the distribution of each member of the dioxin and DLCs category as percentages among the 17 category members. This is only required if such information is available from the facility's data used to report**
  - **Allows conversion of reported quantity into individual chemical estimates and TEQs**
  - **List is in EPA's *TRI Reporting Forms and Instructions* document**
  - **Do not check NA unless you are reporting for dioxin and DLCs**

**1.4 Distribution of Each Member of the Dioxin and Dioxin-like Compounds Category.**

(If there are any numbers in boxes 1-17, then every field must be filled in with either 0 or some number between 0.01 and 100. Distribution should be reported in percentages and the total should equal 100%. If you do not have speciation data available, indicate NA.)

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NA | ☐ | | | | | | | | | | | | | | | | |



## DIOXIN AND DIOXIN-LIKE COMPOUNDS

**Calculating Section 1.4 using EPA's default emission factors for oil-fired utility boilers**

| No. | Member Name | Concentration (pg/L oil) | Relative Percentage | No. | Member Name | Concentration (pg/L oil) | Relative Percentage |
|---|---|---|---|---|---|---|---|
| 1 | 1,2,3,4,6,7,8-HpCDF | 164 | 5.16% | 10 | 1,2,3,4,6,7,8-HpCDD | 477 | 15.01% |
| 2 | 1,2,3,4,7,8,9-HpCDF | 0 | 0% | 11 | 1,2,3,4,6,7,8,9-OCDF | 0 | 0% |
| 3 | 1,2,3,4,7,8-HxCDF | 76.5 | 2.41% | 12 | 1,2,3,4,6,7,8,9-OCDD | 2055 | 64.65% |
| 4 | 1,2,3,6,7,8-HxCDF | 35.4 | 1.11% | 13 | 1,2,3,7,8-PeCDF | 64.1 | 2.02% |
| 5 | 1,2,3,7,8,9-HxCDF | 0 | 0% | 14 | 2,3,4,7,8-PeCDF | 49.3 | 1.55% |
| 6 | 2,3,4,6,7,8-HxCDF | 23.8 | 0.75% | 15 | 1,2,3,7,8-PeCDD | 24.7 | 0.78% |
| 7 | 1,2,3,4,7,8-HxCDD | 63.3 | 1.99% | 16 | 2,3,7,8-TCDF | 0 | 0% |
| 8 | 1,2,3,6,7,8-HxCDD | 65.8 | 2.07% | 17 | 2,3,7,8-TCDD | 0 | 0% |
| 9 | 1,2,3,7,8,9-HxCDD | 79.7 | 2.51% | | | | |

**Source: EPA's *Guidance for Reporting Toxic Chemicals within the Dioxin and Dioxin-like Compounds Category* (Ref. 1).**

**1.4 Distribution of Each Member of the Dioxin and Dioxin-like Compounds Category.**

(If there are any numbers in boxes 1-17, then every field must be filled in with either 0 or some number between 0.01 and 100. Distribution should be reported in percentages and the total should equal 100%. If you do not have speciation data available, indicate NA.)

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NA | ☐ | 5.16 | 0 | 2.41 | 1.11 | 0 | 0.75 | 1.99 | 2.07 | 2.51 | 15.00 | 0 | 64.65 | 2.02 | 1.55 | 0.78 | 0 | 0 |



## DIOXIN AND DIOXIN-LIKE COMPOUNDS

- **Example calculation of emissions for a system that emits 1 gram per year of Octachlorodibenzofuran (OCDF) and 1 gram per year of 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin**
  - **Correct quantity to report on Form R is 2 grams**
  - **Do not use the TEQ quantity, which is 0.0101 grams (TEFs are 0.0001 and 0.01)**



## DIOXIN AND DIOXIN-LIKE COMPOUNDS

- **Dioxin and DLCs may be manufactured when chlorine-containing materials are involved in combustion or other high-temperature processes**
- **Default air emission factors (Ref. 1):**
  - **1.71 nanograms of dioxin and DLCs per kilogram of coal combusted in an utility boiler (equivalent to 1.55 grams per million tons)**
  - **3,178.6 nanograms (or 3.1786 picograms) of dioxin and DLCs per liter of fuel oil combusted in an utility boiler (equivalent to 0.0120 grams per million gallons)**
  - **12.2 nanograms of dioxin and DLCs per kilogram of hazardous waste combusted in a boiler or industrial furnace (other than a cement kiln) (equivalent to 11.1 grams per million tons)**

## DIOXIN AND DIOXIN-LIKE COMPOUNDS

- **Additional default air emission factors (Ref.1):**
  - 89.78 nanograms of dioxin and DLCs per kilogram of copper scrap fed to a secondary copper smelter (equivalent to 0.0815 grams per thousand tons)
  - 16.24 nanograms of dioxin and DLCs per kilogram of wood (dry wt.) combusted in an utility boiler (equivalent to 14.73 grams per million tons)
  - 2.4 nanograms of dioxin and DLCs per kilogram of wood waste and bark (as fired) at pulp mills or lumber and wood product industry facility boilers (equivalent to 2.2 grams per million tons)



## DIOXIN AND DIOXIN-LIKE COMPOUNDS

- **Additional default factors (Ref.1):**
  - 105.7 picograms of dioxin and DLCs per liter of waste water from bleached chemical pulp mills discharged to surface water (equivalent to 0.400 grams per million gallons)
  - 500 nanograms of dioxin and DLCs per kilogram of waste water sludge from bleached chemical pulp mills (equivalent to 0.454 grams per thousand tons)



## DIOXIN AND DIOXIN-LIKE COMPOUNDS

- **Examples of activities that exceed the 0.1 gram activity threshold:**
  - 64,500 tons of coal need to be combusted in an utility boiler to exceed the threshold
  - 8.33 million gallons of fuel oil need to be combusted in a utility boiler to exceed the threshold
  - 1,230 tons copper scrap need to be fed to a secondary copper smelter



## DIOXIN AND DIOXIN-LIKE COMPOUNDS

- **For more information:**

1. *Guidance for Reporting Toxic Chemicals within the Dioxin and Dioxin-like Compounds Category*. U.S. EPA, Office of Information Analysis and Access. December 2000. Available at http://www.epa.gov/tri

2. *Exposure and Human Health Reassessment of 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD) and Related Compounds. Part 1: Estimating Exposure to Dioxin-Like Compounds. Volume 2: Sources of Dioxin-Like Compounds in the United States*. U.S. EPA, Office of Research and Development. 2000. Available at http://www.epa.gov/ncea/pdfs/dioxin/part1and2.htm